

CLAIMS

What is claimed is:

1. A method for communicating a radio access network (RAN) signaling
5 message between a radio network controller (RNC) and a core
switching network, the method comprising:
 - (a) receiving, from an RNC, a RAN signaling message that includes
an asynchronous transfer mode (ATM) protocol component
and an application part protocol component;
 - 10 (b) encapsulating the application part protocol component of the
RAN signaling message within a first protocol envelope;
 - (c) replacing the ATM protocol component of the RAN signaling
message with a non-ATM protocol component; and
 - (d) transmitting the RAN signaling message to a core network.
- 15 2. The method of claim 1 wherein receiving a RAN signaling message
including an ATM protocol component includes receiving a RAN
signaling message having an ATM adaptation layer 5 (AAL5) layer.
- 20 3. The method of claim 1 wherein receiving a RAN signaling message
including an ATM protocol component includes receiving a RAN
signaling message having a service specific connection oriented
protocol (SSCOP) layer.

4. The method of claim 1 wherein receiving a RAN signaling message that includes an ATM protocol component includes receiving a RAN signaling message having a service specific coordination function network to network interface (SSCF-NNI) layer.

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5. The method of claim 1 wherein receiving a RAN signaling message that includes an application part protocol component includes receiving a RAN signaling message having a signaling connection control part (SCCP).

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6. The method of claim 1 wherein receiving a RAN signaling message that includes an application part protocol component includes receiving a RAN signaling message having a RAN application part (RANAP).

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7. The method of claim 1 wherein receiving a RAN signaling message that includes an application part protocol component includes receiving a RAN signaling message having a Q.2150.1 protocol component.

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8. The method of claim 1 wherein receiving a RAN signaling message that includes an application part protocol component includes receiving a RAN signaling message having a Q.2630.1 protocol component.

9. The method of claim 7 comprising:
(a) determining a Q.2150.1 message type of the RAN signaling message;

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- (b) mapping the Q.2150.1 message type to an M3UA message type, and wherein encapsulating the application part in a first protocol envelope includes encapsulating the application part in an M3UA envelope having the M3UA message type.

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- 10. The method of claim 7 wherein encapsulating the message in a first protocol envelope includes encapsulating the Q.2130.1 protocol component in an M3UA DATA message envelope without examining the Q.2130.1 component.

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- 11. The method of claim 1 wherein encapsulating the application part protocol component within a first protocol envelope includes encapsulating the application part protocol component within an SS7 SCCP User Adaptation (SUA) layer.

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- 12. The method of claim 1 wherein encapsulating application part protocol component within a first protocol envelope includes encapsulating the application part protocol component within an SS7 MTP3 user adaptation (M3UA) layer.

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- 13. The method of claim 1 wherein encapsulating the application part protocol component within a first protocol envelope includes encapsulating the application part protocol component in a transport adapter layer interface (TALI) protocol component.

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14. The method of claim 1 wherein replacing the ATM protocol component with a non-ATM protocol component includes replacing the ATM protocol component with an Internet protocol (IP) component.

5 15. The method of claim 14 wherein replacing the ATM protocol component with a non-ATM protocol component includes replacing the ATM protocol component with a transmission control protocol (TCP) component.

10 16. The method of claim 14 wherein replacing the ATM protocol component with a non-ATM protocol component includes replacing the ATM protocol component with a stream control transmission protocol (SCTP) component.

15 17. The method of claim 1 including generating a billing information record based on information contained in the received RAN signaling message.

20 18. The method of claim 17 wherein generating a billing information record based on information contained in the received RAN signaling message includes using a mobile identification number (MIN) contained in the RAN signaling message.

25 19. The method of claim 17 wherein generating a billing information record based on information contained in the received RAN signaling

message includes using a mobile subscriber uniform resource locator (URL) contained in the RAN signaling message.

20. The method of claim 17 wherein generating a billing information record
5 based on information contained in the received RAN signaling message includes using a mobile subscriber email address contained in the RAN signaling message.

21. The method of claim 17 wherein generating a billing information record
10 based on information contained in the received RAN signaling message includes using a service provider identifier contained in the RAN signaling message.

22. A method for routing and converting messages communicated between
15 a stream control transmission protocol (SCTP)-based core network and a radio network controller (RNC), the method comprising:

- 20 (a) receiving a first message from an RNC including radio access network application part (RANAP), signaling connection control part (SCCP), message transfer part layer 3 broadband (MTP3B), service specific coordination function (SSCF), service specific connection oriented protocol (SSCOP), asynchronous transfer mode adaptation layer 5 (AAL5), and asynchronous transfer mode (ATM) layers;
- 25 (b) removing the SSCOP, AAL5, and ATM layers from the first message;

- (c) using the MTP3B layer of the first message to determine an outbound SCTP association and stream for the first message;
- (d) adding an SS7 SCCP user adaptation (SUA) layer to the RANAP and SCCP components of the first message;
- 5 (e) encapsulating the SUA, RANAP, and SCCP layers of the first message in an SCTP/IP envelope; and
- (f) routing the first message to the core network over the outbound SCTP association and stream.

- 10 23. The method of claim 22 comprising receiving a second message from the core network including RANAP, SCCP, SUA, and SCTP/IP layers;
- (a) removing the SCTP/IP layer from the second message;
 - (b) examining destination information in the SUA layer of the second signaling message to determine a destination point code of the second message;
 - 15 (c) based on the destination point code, formulating a routing label for the RANAP and SCCP layers of the second message; and
 - (d) routing the second message to the RNC based on the routing label over a high-speed ATM link.

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24. A method for routing and converting messages communicated between a stream control transmission protocol (SCTP)-based core network and a radio network controller (RNC), the method comprising:
- (a) receiving a first message from an RNC including Q.2630.1, Q.2150.1, SS7 message transfer part layer 3 broadband
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(MTP3B), service specific coordination function (SSCF), service specific connection oriented protocol (SSCOP), asynchronous transfer mode adaptation layer 5 (AAL5), and asynchronous transfer mode (ATM) layers;

- 5 (b) removing the SSCOP, AAL5, and ATM layers from the first message;
- (c) using the MTP3B layer to determine an outbound SCTP association and stream for the first message;
- (d) mapping the Q.2150.1 layer of the first message to an M3UA layer;
- 10 (e) encapsulating the Q.2630.1, Q.2150.1, and M3UA layers of the first message in an SCTP/IP header; and
- (f) routing the first message to the core network over the SCTP association and stream.

15 25. The method of claim 24 comprising:

- (a) receiving a second message from the core network including Q.2630.1, Q.2150.1 , M3UA , and SCTP/IP layers;
- (b) removing the SCTP/IP layer from the second message;
- 20 (c) generating a routing label for the second message based on SS7 address information contained in the M3UA layer of the second message; and
- (d) using the routing label to route the second message to the radio network controller over an SS7 signaling link.

26. The method of claim 24 wherein mapping the Q.2150.1 layer to an M3UA layer includes mapping every Q.2150.1 layer message received from the radio network controller to an M3UA DATA message.
- 5 27. The method of claim 24 wherein mapping a Q.2150.1 layer to an M3UA layer includes examining the Q.2150.1 layer to determine a Q.2150.1 message type and mapping the Q.2150.1 message type to an M3UA message type.
- 10 28. A method for processing radio access network application part (RANAP) messages received from a radio network controller (RNC), the method comprising:
- 15 (a) receiving a message including RANAP, signaling connection control part (SCCP), message transfer part layer 3 broadband (MTP3B), and asynchronous transfer mode (ATM) components;
- (b) removing the ATM component from the message;
- (c) replacing the SCCP component of the message with an SS7 SCCP user adaptation (SUA) component;
- 20 (d) using the MTP3B component of the message to select an outbound stream control transmission protocol (SCTP) association and stream for the message;
- (e) removing the MTP3B component from the message;
- (f) adding an SCTP/IP component to the message; and
- 25 (f) transmitting the message to a core network over the SCTP association and stream.

29. A routing node for routing a radio access network (RAN) signaling message between a radio network controller (RNC) and a core switching network, the routing node comprising:

- 5 (a) a first communication module for receiving messages from an RNC including application-level components and ATM components and for removing the ATM components from the messages; and
- 10 (b) a second communication module for receiving the application-level components from the first communication module, encapsulating the application-level components from each of the messages in an adaptation layer, encapsulating the adaptation layer in a lower-level protocol other than ATM, and routing the encapsulated messages to a core network.

15 30. The routing node of claim 29 wherein the first communication module is an ATM link interface module.

31. The routing node of claim 29 wherein the second communication module is a radio data communication module (rDCM).

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32. The routing node of claim 29 wherein the lower-level protocol includes a stream control transmission protocol (SCTP) component.

33. The routing node of claim 29 wherein the lower-level protocol includes a transmission control protocol (TCP) component.
34. The routing node of claim 29 wherein the lower-level protocol includes an Internet protocol (IP) component.
35. The routing node of claim 29 wherein the adaptation layer includes an SS7 signaling connection control part user adaptation (SUA) layer.
36. The routing node of claim 29 wherein the adaptation layer includes an SS7 message transfer point layer 3 user adaptation (MUA) layer.
37. The routing node of claim 29 wherein the adaptation layer includes a transport adapter layer interface (TALI) component.
38. The routing node of claim 29 wherein the application-level components include a signaling connection control part (SCCP) component.
39. The routing node of claim 29 wherein the application-level components include a radio access network application part component.
40. The routing node of claim 29 wherein the application-level components include a Q.2630.1 component.

41. The routing node of claim 29 wherein the application-level components include a Q.2150.1 component.
- 5 42. The routing node of claim 29 wherein the second communication module is adapted to route the encapsulated message to a media gateway controller in the core network.
- 10 43. The routing node of claim 29 wherein the second communication module is adapted to route the encapsulated message to a softswitch in the core network.
44. The routing node of claim 29 including a billing subsystem for generating usage and billing information.
- 15 45. The routing node of claim 44 wherein the billing subsystem is adapted to generate bills or invoices.
46. The routing node of claim 44 wherein the billing information includes a mobile subscriber identifier.
- 20 47. The routing node of claim 44 wherein the billing information includes a service provider identifier.
- 25 48. The routing node of claim 29 wherein the second communication module is adapted to receive messages from the core network having

application-level components encapsulated in the lower-level protocol, removing the application-level components, and forwarding the application-level components to the first communication module.

5 49. The routing node of claim 48 wherein the first communication module is adapted to receive the application-level components from the second communication module, add ATM components to the application-level components, and forward the messages having the application- and ATM components to a radio network controller.

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50. A radio access network gateway comprising:

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(a) a high-speed link module for receiving a first message including radio access network application part (RANAP), signaling connection control part (SCCP), SS7 message transfer part layer 3 broadband (MTP3B), service specific coordination function (SSCF), service specific connection oriented protocol (SSCOP), asynchronous transfer mode adaptation layer 5 (AAL5), and asynchronous transfer mode (ATM) components, removing the SSCF, SSCOP, AAL5, and ATM components from the first message, and routing the first message based on the MTP3B component; and

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(b) a radio data communications module (rDCM) for receiving the RANAP, and SCCP, and MTP3B components of the first message, determining an outgoing SCTP association and stream for the first message, then discarding the MTP3B

component, adding an SS7 SCCP user adaptation (SUA) component to the first message, encapsulating the first message in a stream control transmission protocol/internet protocol SCTP/IP envelope, and routing the first message to the core network over the SCTP association and stream.

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51. The radio access network gateway of claim 50 wherein the rDCM is adapted to receive a second message from the core network including RANAP, SCCP, SUA, SCTP, and IP components, wherein the rDCM removes the SCTP and IP components from the second message, determines a routing label based on address information contained in the SUA component of the second message, and routes the second message to the RNC based on the routing label over a high-speed ATM link.

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52. A radio access network gateway comprising:

- (a) a high-speed link (HSL) module capable of receiving a first message from a radio network controller, the first message including Q.2630.1, Q.2150.1, MTP layer 3 broadband (MTP3B), service specific coordination function (SSCF), service specific connection oriented protocol (SSCOP), asynchronous transfer mode adaptation layer 5 (AAL5), and asynchronous transfer mode (ATM) components, removing the SSCF, SSCOP, AAL5, and ATM components, and routing the first message based on the MTP3B component; and

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(b) a radio data communications module (rDCM) for receiving the Q.2630.1, Q.2150.1, and MTP3B components of the first message, determining a stream control transmission protocol (SCTP) association and stream for the message based on the MTP3B component and discarding the MTP3B component, adding an SS7 MTP level 3 user adaptation (M3UA) component to the first message, encapsulating the first message in an SCTP/IP envelope, and routing the first message to the core network over the SCTP association and stream.

53. The method of claim 52 wherein the rDCM is adapted to receive a second message from the core network including Q.2630.1, Q.2150.1, M3UA, and SCTP/IP components, wherein the rDCM discards the SCTP/IP component, determines a routing label for the second message based on the M3UA component, adds the routing label to the second message, and routes the second message to the HSL module based on the routing label, and wherein the HSL module routes the second message to the RNC based on the routing label.

54. The RAN gateway of claim 52 wherein adding an M3UA layer to the first message includes encapsulating the first message in an M3UA DATA message regardless of the Q.2150.1 message type contained in the Q.2150.1 layer of the first message.

55. The RAN gateway of claim 52 wherein adding an M3UA layer to the first message includes examining the Q.2150 layer of the first message to determine the Q.2150 message type and mapping the Q.2150 message type to an M3UA message type.

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